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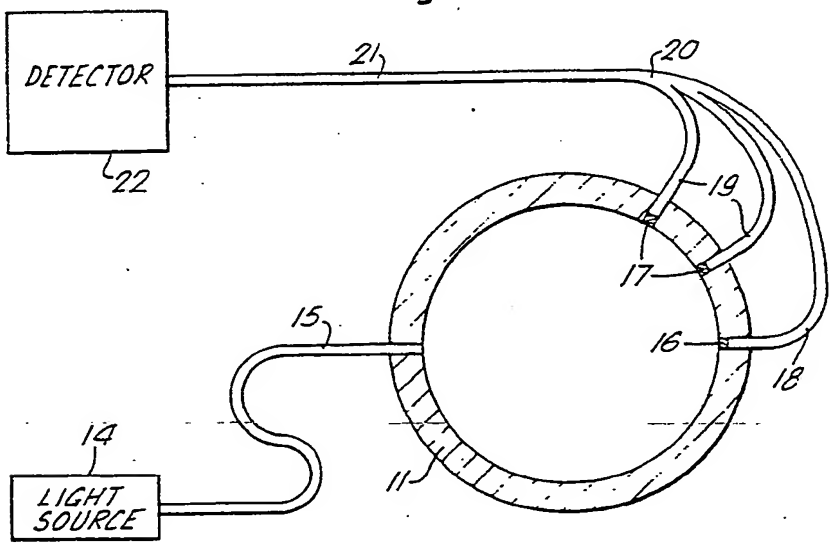
(54) Water contaminant meter

(57) In a water contaminant meter, e.g. for oil in water measurement, light signals transmitted through the water and light signals scattered by the contaminant are multiplexed on to a single optical path 21 for transmission to a detector/analyser 22. A light source 14 generates a plurality of different wavelengths simultaneously or sequentially. Optical filters 16, 17 are associated respectively with the transmitted and scattered light. In a modification, the filters 16, 17 and separate optical fibres 18, 19 are replaced by a graded index optical filter, a transparent body, and a reflector.

Fig.1.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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Fig.1.

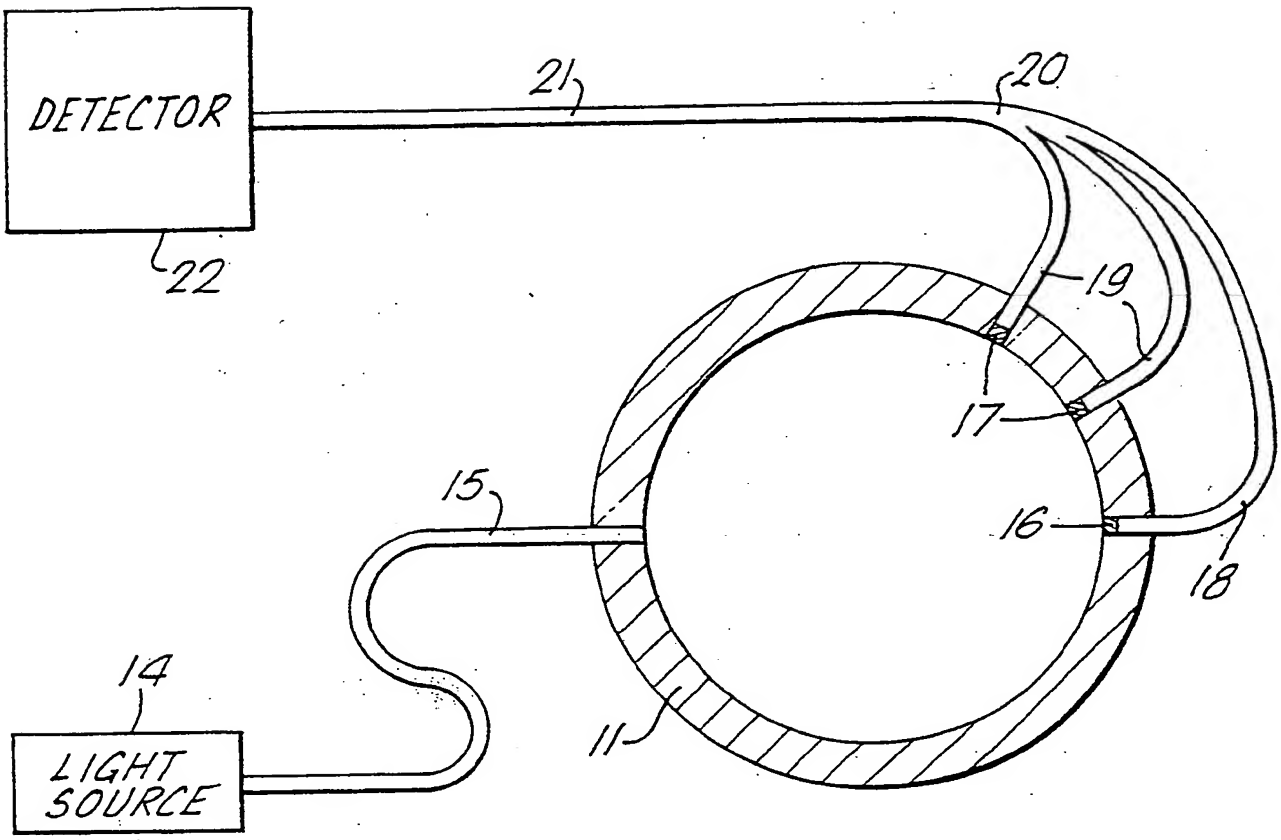
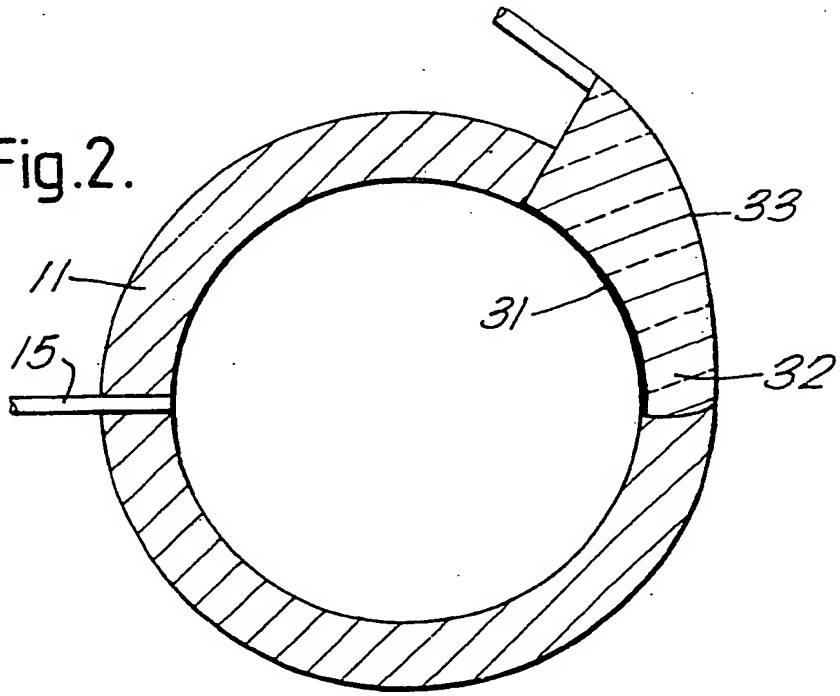


Fig.2.



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WATER CONTAMINATION METER

This invention relates to instruments for the detection and measurement of contamination in water.

Our published UK specification No. 1556029 (G.D. Pitt - H.J. Smith 19-4) describes and claims on oil in water detector arrangement, including a cell in through which the water is allowed to flow, a semiconductor laser operable in the infra-red region of the spectrum and coupled to one side of the cell, and one or more photodetectors arranged at an angle to the laser beam so as to detect the laser light scattered from oil droplets in the water.

The present invention is concerned with the optical arrangement associated with the instrument test cell.

According to the invention there is provided a meter for measuring contamination in liquid, the meter including a test cell through which contaminated liquid may be directed, means for directing light into the cell whereby light is transmitted through the cell and scattered from the contaminant, wavelength selective means for receiving light signals transmitted through the cell and scattered at one or more predetermined angles, means for multiplexing the received light signals on a common optical path, and means for determining from said multiplexed signals the level of contamination in the liquid.

According to the invention there is further provided a water contaminant meter, including a test cell through which water contaminated may be directed, means for directing light signals of first and second wavelengths into said cells whereby light is transmitted through the cell or is scattered by the contaminant, first optical filter means having a pass band corresponding to the first wavelength and so disposed as to receive light transmitted through the cell, second optical filter means having a pass band corresponding to the second wavelength and so disposed as to receive light scattered at a predetermined angle by the contaminant, means for multiplexing light signals from the first and second filters on to a common optical path, and means for determining from said multiplexed signals the level of contamination in the water.

Embodiments of the invention will now be described with reference to the accompanying drawings in which:-

Figure 1 is a schematic diagram of contaminant measurement arrangement;

and Figure 2 shows an alternative test cell construction for use with the arrangement of Figure 1.

Referring to Figure 1 the measurement arrangement includes a cell 11 through which contaminated water is directed via an inlet and outlet (not shown). Light signals generated by light wave 14 are carried into the cell 11 via optical fibre 15. The light source 14 may be adapted to generate light signals of discrete wavelengths or in some applications, a range of wavelengths. The light source may comprise a number of lasers or light emitting diodes, or it may comprise a single laser which is current modulated to provide a plurality of output wavelengths. The different

wavelengths may be generated simultaneously or sequentially.

Within the cell, some light is scattered by the contaminant within the water whilst the remainder in general the major portion, is transmitted across the cell. The reduction of the transmitted light intensity in comparison with clean water, and the intensity of scattered light, together give an accurate measure of the level of oil contamination in the water.

The light signals output from the cell are received by wavelength selective filters 16 and 17 arranged respectively in line with the input light signal so as to receive transmitted light and at an angle to the input light signal so as to received scattered light. In some applications one or more further wavelength selective filters may also be provided to receive light at different scattering angles.

The filters 16 and 17 are coupled to respective optical fibres 18 and 19 which are in turn coupled by a beam combiner 20 to a common optical fibre 21. The light signals thus multiplexed are transmitted via fibre 21 t a detector 22. At the detector the light signals are demultiplexed and analysed to a given measure of the level of contamination within the cell. A method of calculating contaminant level from the direct and scattered light intensities is described in our published specification No. 2166234 (S.I.N. Gregorig 5-1).

The arrangement allows the return signals from the cell to be carried via a single fibre rather than the plurality of fibres required in previous arrangements. This simplifies installation and also improves accuracy as all the returned signals transverse the same optical path.

The arrangement is particularly adapted to the measurement of oil contamination in water either in marine or land-based installations. It will be appreciated however that the arrangement is not limited to the measurement of oil contamination but may also be used e.g. in the detection and measurement of suspended solid particles.

Figure 2 shows an alternative test cell construction. In this arrangement an arc of the inner surface of the cell comprises a graded optical filter 31. The filter 31 is contacted with an arcuate transparent, e.g. glass, body 32 the outer surface 33 of which is silvered to provide a reflecting surface. The transparent body 32 provides an optical collection function whereby light signals received from various portions of the filter 31 are multiplexed and launched into optical fibre 34.

It will be appreciated that the contaminant measurement arrangement described herein may either be provided as a new installation or as a retrofit replacement in existing installations.

CLAIMS:

1. A meter for measuring contamination in liquid, the meter including a test cell through which contaminated liquid may be directed, means for directing light into the cell whereby light is transmitted through the cell and scattered from the contaminant, wavelength selective means for receiving light signals transmitted through the cell and scattered at one or more predetermined angles, means for multiplexing the received light signals on a common optical path, and means for determining from said multiplexed signals the level of oil contamination in the liquid.

2. A water contaminant meter, including a test cell through which water contaminated may be directed, means for directing light signals of first and second wavelengths into said cells whereby light is transmitted through the cell or is scattered by the contaminant, first optical filter means having a pass band corresponding to the first wavelength and so disposed as to receive light transmitted through the cell, second optical filter means having a pass band corresponding to the second wavelength and so disposed as to receive light scattered at a predetermined angle by the contaminant, means for multiplexing light signals from the first and second filters on to a common optical path, and means for determining from said multiplexed signals the level of contamination in the water.

3. A water contaminant meter as claimed in Claim 2, wherein the light detecting means comprises one or more semiconductor lasers.

4. A water contaminant meter as claimed in Claims 2 or 3, wherein said first and second optical filter means are provided by a graded index optical filter.

5. A water contaminant meter substantially as described herein with reference to and as shown in Figure 1 or Figures 1 and 2 of the accompanying drawings.

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